SCIENCE

NEW YORK, MAY 29, 1891.

PRESIDENTIAL ADDRESS OF SIR FREDERICK ABEL OF THE IRON AND STEEL INSTITUTE.

THE address of Sir Frederick Abel, the new president of the Iron and Steel Institute, London, at its annual meeting in the early part of this month, as reported in *Engineering*, is full of interest. Sir Frederick went back to the date of his first labors in connection with the iron and steel industry, when, as he said, those in England who could appraise at their proper value the services which the analytical and scientific chemist could render to the ironmaster and manufacturer of steel could be counted upon one's fingers. Shortly before the outbreak of the Russian war, Sir Frederick succeeded the illustrious Faraday in the professorship of chemistry at the Royal Military Academy. The metallurgical operations in the arsenal were then limited to the production of small castings of brass for the fittings of gun carriages, and to the casting of bronze ordnance for field service, which had been carried on at a foundery in Moorfields until 1716, when the services of an experienced Dutch founder, Andreas Schalch, were secured by the government, and a foundery for brass ordnance was established in the Warren at Woolwich, afterwards named the Royal Arsenal. The supplies of cast-iron ordnance for siege and naval use were drawn from a very few of the most renowned iron works, such as Carron, Low Moor, and Gospel Oak, and shot and shell were exclusively supplied from private works. The president next went on to draw a comparison between the old cast-iron smooth-bore ordnance of those days and the elaborate steel breech-loading weapons of the present time.

During the Crimean War more than one disastrous experience with some armaments, supplied by contract during great pressure, led to the adoption of the proposal to establish government founderies and factories in the arsenal for the production of guns and projectiles, and it was with the view of selecting suitable varieties of cast-iron for the production of ordnance and projectiles that a very extensive analytical examination of ores, fuel, and fluxes, and of samples of iron produced from these at various works in the United Kingdom, was carried out under Sir Frederick's direction in 1856–58, together with a series of mechanical experiments with the metal cast under conditions practically identical, and cooled in various ways.

The president next referred to the confusion arising from the different methods of analysis pursued in the determinations of the proportions of alloys in a sample of iron, and gave some particulars of what had been done to bring uniformity in this respect between the chemists of various countries. The consideration of this subject was first prominently brought forward at the Bath meeting of the British Association in 1888 at the instigation of Professor J. W. Langley of Michigan University, who reported that he had, in conjunction with Professor Herman Wedding and Professor Akerman, considered a general plan of operations having for its object the promotion of greater uniformity in analysis in the countries which are the principal producers and users of iron and steel; the proposal being to prepare a series of absolutely identical samples, to distribute these for analysis among highly qualified operators selected in different countries, the results being afterwards compared, and to deposit portions of the samples in those countries as international standards, which might be utilized at any time for testing or controlling the accuracy of individual work, in cases of importance, or for testing the value of new analytical processes. It was decided by the association to appoint a committee of English experts to co-operate with Professor Langley and his associates in other countries, and this committee prepared a number of suggestions with reference to the preparation of a series of five samples of steel, containing, as nearly as possible, specified total proportions of carbon ranging from 1.3 to 0.07 per cent; the samples to be sufficiently large, after providing material for the required analyses by the selected referees, to allow of the disposition of about ten pounds of each standard in each of the different countries interested; the samples to be subdivided into series of small specimens, hermetically sealed in glass tubes, so that portions should be available for supply to applicants without detriment to the remainder of the samples. These suggestions were approved, and have been acted upon as closely as possible, the material for the standards and the mechanical work having been supplied gratuitously by the Crescent Steel Works of Pittsburgh. The samples were despatched to their several destinations in the summer of 1889, and the experts selected for the conduct of their analysis in England have almost completed the work assigned to them.

The address next referred to the method of examination of iron and steel introduced by Dr. Sorby, consisting of microscopic inspection of prepared sections of metal after treatment with weak acid. Faraday and Stodart had formerly proceeded upon somewhat similar lines. Dr. Wedding states that Sorby's system is continually extending at the German works, and that many series of experiments have demonstrated that by this system of examinations characteristic features of grades of iron may be discovered, physical differences co-existing with identity of chemical composition explained, and evidences of the true grounds of disasters obtained. The president also referred to his own labors in a similar direction, in connection with his inquiry into the erosive action of the powder gases, when he showed, in a paper read before the institute, that the development of structure of smooth surfaces of slices of the metal composing the barrels with which experiments were carried out by the very slow solvent action which a chromic acid solution exercises, afforded valuable evidence, attainable by simple inspection, of the comparative amount of work or mechanical treatment to which the different steel forgings had been subjected, and which was demonstrated to affect very importantly the amount of resistance opposed by the surface of the gun's bore to the erosive effects of powder gases. This method of examination, and the production of photographic records of the results, had, however, already been made use of by Sir Frederick twenty-six years ago, at the time when the government first entered upon experiments with projectiles of wrought iron and of steel, for use against armor-plates; and he exhibited some photographs of small plates of metal, exhibiting the effect of the chromic solution referred to, which were attached to a report made by him to the Ordnance Committee in 1865.

Sir Frederick Abel also referred to the microscopic method pursued by M. Osmond in connection with the Le Chatelier pyrometer.

The development of cracks in stored steel projectiles next occupied the president's attention. Previously to 1865 this then new phenomenon had been the subject of an official report he had made. Up to the present day this difficulty has not been altogether overcome, and in the case of built-up steel guns the troubles arising through internal strains due to hardening or tempering have taxed the powers of some of our most eminent scientific and practical authorities. The difficulties which had to be encountered by manufacturers in the production of solid projectiles on the molecular stability of which reliance could be placed, was illustrated by a statement made by an eminent firm, then already possessed of considerable experience in this special manufacture, to the effect that although they were then successful in tempering steel shot without difficulty — by cooling them uniformly both externally and internally — this result had been preceded by many failures. The successful manufacture, within the last five or six

years, by Holtzer, the St. Chamond and Firminy Companies, and other French makers, of the hardened chrome-steel armor-piercing projectiles having only small cavities (without which their production would probably be practically impossible), is a remarkable illustration of the control which has been acquired over the treatment of steel, and especially of varieties, such as this chrome-steel, to which a very exceptional degree of hardness may be imparted without detriment to tenacity, by carefully elaborated processes of hardening and tempering. Experience in the application of these appears to have conquered, at any rate, in very great measure, the originally considerable tendency to the retention of a state of unequal tension by the finished material for long periods, and the frequent yielding of the mass to the disruptive force thereby exerted.

In visiting, in 1886, the several works at and near St. Etienne, where the chrome-steel projectiles were being produced (their successful manufacture being then of comparatively recent date) Sir Frederick saw, at more than one establishment, a large number of projectiles which had sustained spontaneous fracture. In one store where the finished shot were stacked, after the lapse of the period during which the tendency to the development of cracks or to rupture was stated to diminish gradually, he saw the head of one out of a pile of projectiles which had quite recently been projected to a distance of many feet by the violent spontaneous rupture of the metal. Instances of the development of flaws in these projectiles are now, so far as experience at Woolwich goes, exceedingly rare.

The address next proceeded to point out the importance of rest in bringing about a diminution, if not an entire disappearance, of internal strains; and he referred to the analogous case of steel dies for coining. Sir Thomas Graham had written the president a letter in 1865, in which he stated that, if kept in store a year or two, these dies became less apt to crack when in use, and coined more pieces than dies newly tempered. The more important question of internal strains in masses of steel composing the tubes or barrels of guns next received attention in the address. The condition in which the steel might have been, in such instances, when subjected to the action of the exploding powder charge, may be illustrated by reference to the behavior some years ago of the tube of a large gun, in which, after the third proof-round was fired, a circumferential crack was found to have become developed in the front threads of the breech screw. Upon removing the jacket from the tube, the crack extended forward along the chamber and into the rifling, and when the tube was placed in the lathe with a view of cutting off the injured portion, the crack suddenly developed itself with a loud report, and ran along to within eight feet of the muzzle; a spiral crack at the same time ran completely round the tube, which fell in two upon removal from the lathe.

The tempering with oil hardening of steel guns has been demonstrated to result in the development of more or less severe internal stresses in the mass, which can only be removed by subsequent careful annealing; and until this latter practice was largely adopted, instances occurred from time to time at Woolwich, and at other gunmaking establishments, of the fracture of tubes and hoops of guns, either during their treatment in the workshop, or when at rest, or when, in the built-up condition, they have been for the first time exposed to the shock produced by the firing of the gun. One effect which the oil-hardening treatment has occasionally exercised in the case of particular qualities of steel is that of developing minute fissures or cracks in the metal, either superficially or in the interior of the mass. This could not be rectified by any annealing process, and it is still a question, to be determined by the teachings of experience and the results of investigations, whether any definite or reliable modifications in the composition of steel used for guns, tending to secure the desired combination of hardness and tenacity, may not be introduced, with the result that a method of treatment of the metal may be discarded, which — however carefully applied, and however efficient the means adopted for reducing or neutralizing any possible prejudicial influence upon the physical stability of the parts of which a gun is built up — carries with it inherent elements of uncertainty and possible danger.

Turning to another branch of this subject, the president next dwelt upon the investigations of Mr. Thomas Turner and Mr. Keep upon the influence of silicon and other impurities in cast-iron, a question which Sir Frederick had taken up in 1855. The work of Gautier, Ledebur, and others, based upon Turner's information, and the investigations of German experimentalists, have combined to establish on a sound footing the value of ferro-silicon in connection with the treatment of cast-iron. Jüngst's experiments seem to indicate clearly the conditions under which silicon will contribute to the production of dense and homogeneous castings.

Sir Frederick then made some observations on the development of the basic process, and also the effect of aluminum and of manganese as alloys of iron. The question of nickel-steel also occupied a good deal of the address, Sir Frederick giving an excellent *résumé* of what has already been done in this direction chiefly in connection with armor-plate construction.

EPIDEMICS OF CHOLERA FROM 1830 TO 1890.

DR. WILLOUGHBY, in a paper before the Epidemiological Society of London, condensed in a recent number of the *Lancet*, after alluding to the doctrine of epidemic influences, telluric and atmospheric conditions, and other unknown agencies, as at once baseless and needless, and to the opposite delusion, prevalent in the south of Europe, of its being infectious in the same sense as small-pox, asserted that all the independent and scientific students of the subject in Europe and America were now agreed that the vehicle of contagion was contained in the evacuations, that it was thus carried by fomites as soiled clothing, etc., while persons suffering from the disease, even in unrecognized and mild forms, infected the soil and water of places through which they passed. Insanitary conditions favored its development, but the most insanitary towns — as Rome, Seville, and others — had escaped, since they had been provided with pure water supplies.

The incubation period he believed to be, as a rule, from one to two days, four being an ample limit for quarantine purposes. Its transportability and conveyance wholly and solely by human intercourse was proved not only by the progress of every epidemic having followed the great routes of trade and pilgrimages. but by the rapidity of this progress having corresponded to the facilities for travel, whether by caravans, river boats, railways, or ocean steamers, quoting in this connection Dr. de Renzy and others as to the altered circumstances of travel in northern India; and he thus explained the immunity of Australia and Chili, virtually the most isolated communities in the civilized world.

It was, he said, in 1821 that cholera. so far as was known, first advanced from India westward, reaching Astrakhan in 1823, but subsiding until 1827, when a fresh wave swept over Persia, entering Russia in 1829. In 1830–31 it was fomented by the war in Poland; in 1831–32 it spread over the whole of Europe, and in 1832–33, over North America, lingering in each continent for about two years longer. It was remarkable, and totally inconsistent with the theory of conveyance by winds, that, though some cases had occurred on board ships in the Medway as early as July, 1831, it did not reach London till February, 1832, having effected a landing at Sunderland and travelled via Newcastle, Edinburgh, Glasgow, Belfast, Dublin, and Cork, whence it was at length brought to London.

A wave rolled over Persia, Arabia, and Syria between 1836 and 1839, but retired again. In 1840 it entered China, then passed westward through Central Asia, re-entering India from Afghanistan and through northern Persia, reaching the Caspian and Black Seas in the summer of 1847. Following the military road then in course of construction from the Caucasus to Moscow, and the river highway of the Volga, it was intensified and spread by the fair at Nijni Novgorod and the massing of the Russian, Austrian, and insurgent Hungarian armies on the Danube, and in the course of 1848–49 had attacked every country in Europe except Denmark and Greece, which were saved by stringent quarantine. It extended to America in 1849, but died out in the course of the following year.

The epidemic of 1854 was not strictly a separate invasion, but rather a resuscitation of the last, which had lingered in the south and east of Europe and the west of Asia until called into fresh activity by the Crimean war. Every country in Europe and America was again invaded. The incidents of the outbreaks in America threw great light on the conveyance of the disease by fomites. The epidemic of 1865–66, which was the first to come wholly by the Red Sea, spread rapidly over Europe and America; but had scarcely subsided when a fresh explosion occurred at the Hurdwar fair in India in 1867, whence it was carried to Persia and Russia, being re-intensified *en route* by the pilgrimage at Great Mesched in 1868, and the fairs at Nijni Novgorod in 1869 and 1870.

At the close of the Franco-German war every country in Europe was attacked except Great Britain, and America succeeded in averting its importation until 1873. By 1874 it had, however, disappeared everywhere on this side of India. In 1881–83 it prevailed in Arabia and Egypt; in 1884 it made its appearance in France, and soon raged throughout Italy and Spain. The influence of pure water supplies was brought into special prominence, not only in the case of single towns in Italy and Spain, but in the almost complete immunity enjoyed by Germany, which had previously suffered heavily in every epidemic.

Cholera lingered in the south until the end of 1885, since which date it had been absent from the continent of Europe until the isolated outbreak in Spain in 1890. This, Dr. Willoughby was convinced, was not imported from the East, but was a recrudescence of the epidemic of 1884–85, brought about by excavations in infected ground. Still cholera had, since 1888, been slowly but steadily advancing by the Persian Gulf and the extensions of that route. It had last year reached the shores of the Caspian and Black Seas, and had raged at Mecca, though Egypt had almost miraculously escaped, and it had persisted at Aleppo and the Syrian ports certainly as late as January of the present year. He had little doubt, that, as its march had closely corresponded with that in 1845–47, we might expect history to repeat itself in an invasion of southern and eastern Europe during the coming summer, unless, as in 1823 and 1839, it should retire, after having thus approached the confines of Europe. If, however, it had not already really died out, the vast increase of communication between the two continents rendered such recession less probable than it was fifty years ago. The paper was illustrated by a number of maps showing the great routes and the course of each epidemic in Asia, Europe, and America.

NOTES AND NEWS.

DURING the early part of May, according to the Cairo correspondent of the London *Times*, there have been in Upper and Lower Egypt large swarms of locusts, which have caused much alarm, as it is believed that they originate from eggs laid last year. The damage done to the young maize, sugar, and cotton is as yet insignificant, though some individual growers have had to re-sow cotton patches which had been devastated. The provincial mudirs have received orders to do everything in their power to secure the extermination of the locusts. The correspondent says that this is the most serious reappearance of an old Egyptian plague that has been recorded for about forty years.

— The National Geographic Society was organized in January, 1888, "to increase and diffuse geographic knowledge." It is incorporated under the laws of the District of Columbia, and has at present an active membership of about four hundred. The publication of a magazine was early determined upon as one of the means of increasing and diffusing geographic knowledge, and two volumes of the *National Geographic Magazine* have been published in the form of a quarterly journal. During the past two years it has been found that the form of publication adopted at the outset meets but imperfectly the needs of the society. In the first place, since the season of active work in the society includes the winter months only, there was an excess of material for the two earlier numbers and a dearth of material for the two later numbers of the volume; and in the second place, the necessity for holding articles until sufficient material for a number was received sometimes led to delay in publishing interesting and important matter. Accordingly it has been decided to discontinue the quarterly form and to publish the magazine in the form of a series of brochures, each issued as promptly as possible after reception of the material. While the *National Geographic Magazine* is edited by and constitutes the organ of the National Geographic Society, it is not limited to this function; and, as was announced in the first number of the journal, "its pages will be open to all persons interested in geography, in the hope that it may become a channel of intercommunication, stimulate geographic investigation, and prove an acceptable medium for the publication of results." The aim of the founders has been to form a continental rather than a local society. That this aim has measurably succeeded is indicated by the fact that although the National Geographic Society is only three years old there are fifty-seven non-resident members, distributed over twenty-seven states and territories. One of the means adopted by the National Geographic Society for increasing geographic knowledge has been, as is well known, that of exploration.

— The annual report of Daniel Draper, Ph.D., director of the New York Meteorological Observatory for the year 1890, shows that during the past year the daily work of the observatory has been uninterruptedly kept up, and complete registers have been obtained of the temperature and pressure of the air; of the direction, force, and velocity of the wind; of the total amount of every rain, the temporary variation of every shower, and the depth of every snow. Not a day, even including Sundays and holidays, has been lost. The registers containing all this large amount of information have been properly arranged and filed away in suitable books. Readings are taken at Smithsonian hours, and also hourly readings from self-recording instruments. Eye observations of clouds are recorded, and the daily and monthly means, etc., are calculated from the instrumental records.

— Bulletin No. 49 of the Ohio Agricultural Experiment Station contains a communication from Mr. G. B. Strong of Cuyahoga County, Ohio, giving an account of his experience in spraying plum-trees the past season. He sprayed forty trees with London purple, at the rate of one pound to 150 gallons of water. Three applications were made, the first one being applied when the fruit was about the size of a small pea. The spray was put on until the leaves began to drip. Twenty-five bushels of plums were gathered from the forty trees, and not one per cent of the crop was stung. Two trees in the vicinity that were not sprayed had all their fruit stung. The foliage was injured somewhat, so Mr. Strong says that the solution was too strong, and that hereafter he will use one pound of London purple to 200 gallons of water, spraying more lightly, and applying only twice unless a third application becomes necessary. It is probable that Paris green would be better for spraying plum-trees than London purple, as it usually contains less soluble arsenic, and consequently is less liable to injure delicate foliage. It may be used at the rate of three ounces to fifty gallons of water. Some spraying experiments were also made by Mr. William Miller, a leading fruit grower of Ottawa County, Ohio. Having two pear orchards several rods apart, the fruit of which had for some years been greatly injured by the plum curculio, he determined to spray one of them. The larger orchard, containing several hundred trees, was accordingly sprayed twice with London purple — four ounces to fifty gallons of water. The fruit in this orchard was very much less injured by the curculio and other insects than that in the other orchard, which had not been sprayed. Mr. Miller also found the spraying machine a decided help in fighting the curculio in his plum orchard, although he did not rely upon it altogether, but used the jarring method part of the time. In 1888 the station sprayed a number of pear trees with London purple in the proportion of eight ounces to fifty gallons of water. At the same time other trees were sprayed with the same mixture, except that half a peck of fresh slaked lime was added. It was then found that while the trees sprayed with London purple alone had their foliage decidedly injured by the application, those sprayed with the lime and Lon-

don purple were not affected. In 1890 these experiments were repeated in such manner as not only to show the effect of adding lime, but also to determine whether Paris green or London purple is the more liable to cause injury to the foliage. The results of these experiments fully confirm those of 1888 and 1889 in showing the advantage of adding lime, and they further show that Paris green is much less liable to injure foliage than London purple.

— The Massachusetts Board of Health, who for some years past have been experimenting on the treatment of sewage by land filtration, have recently issued a report on the subject, in which they remark that sewage can be more efficiently filtered through open sand than through sand covered with soil. Very fine material like dust in the upper layers of a filter prevents access of air, and when wet, may do this so thoroughly that purification of the sewage is entirely prevented. By allowing periods of intermission, however, so as to allow the upper layers of the filter to dry, a high degree of purification may be attained. The quantity which can be dealt with is, however, then much below that which can be purified when the upper layers are composed of open sand, through which the sewage will rapidly disappear, leaving room for air to enter and come in contact with the thin layers of liquid covering the particles of sand. Filtering areas of sand covered with soil are much increased in efficiency by digging trenches in the direction of a slight incline, about two feet deep and six feet apart, and filling them with coarse sand, the upper layers of which should be removed about once a month and replaced by clean sand. From bacteriological experiments it was found that when the filters were in proper working order the number of organisms in the effluent from the filters were never more than two per cent of those in the raw sewage, and the board think this result may be much improved. Fine sand was found to make a very good filter, being capable of purifying sewage at the rate of 9,600 gallons per acre per day, the number of bacteria in a cubic centimetre of the sewage being reduced from 591,000 to 2,000, and the ammonias to a quarter of one per cent of those in the unfiltered fluid. Garden soil made a very poor filter, but a mixture of fine sand and gravel gave extremely good results, as 25,000 gallons would be purified by it per acre per diem in winter, and 42,000 gallons in summer; the bacteria being reduced from 350,000 per cubic centimetre in the sewage to 14,000 per cubic centimetre in the effluent. Peat was totally inefficient. A filter of sand and loam gave good results as far as purity was concerned, but the rate of filtration was only one-third as great as that of the sand-and-gravel filter.

— At a meeting of the Paris Geographical Society in December last, a letter was read from M. Paul Crampel, the substance of which is given in a recent number of the *Scottish Geographical Magazine*. In his letter M. Crampel describes a dwarf race inhabiting the forests to the north of the Ogowé. M. Crampel found several families of this people at about 13° 20′ east longitude, and 2° north latitude, living among the Fans in a state of vassalage. When a Fan chief becomes sufficiently powerful, he takes under his protection a group of these dwarfs, and establishes them in the bush near his village. They then become his hunters, and, in exchange for the ivory and meat they procure, receive old rags, broken guns, manioc, etc. The Bayaga, on their side, enter this state of servitude voluntarily, for, having no plantations, they cannot otherwise procure vegetable food; but when their feudal lord is too exacting, they leave the neighborhood. Their average height is four feet seven inches. They are squarely built, well proportioned, and muscular. The color of the skin is a yellowish-brown, and hair grows all over their bodies. At first sight one is struck by the prominence of their bushy eyebrows and their high cheek bones. They have short necks, high shoulders, broad and rounded chests, strong arms, and thick wrists. When at rest, their feet are generally turned inwards, and their knees, calves, and feet seem as though they were all in one piece. Their general expression is one of fear, and when any one looks at them they hang their heads and appear to tremble. Each head of a family lives with his children and grandchildren, and into this little community no stranger blood is admitted. When a young Bayaga wishes to marry, he is provisionally adopted into the family of his intended bride, and, after a long period of service in hunting and collecting honey for the community, is allowed to marry; but he must still remain in the family of his wife until he has a son, and this son has killed an elephant. He may then depart with his wife, leaving the son in her stead. Polygamy is permitted, but the scarcity of women and the family organization place great obstacles in the way of its practice.

— For the preservation of hydrogen peroxide Kingzett recommends the addition of a small amount of ether. Experiments conducted by the author show, according to the *Medical Record*, that pure hydrogen peroxide lost, in twenty-eight days, 10 per cent; in ninety-eight days, 27.4 per cent; in two hundred days, 39 per cent; and in four hundred and ninety days, 89.2 per cent. The addition of sulphuric acid reduced these figures to 9, 23, $27\frac{1}{2}$, and 68.3, respectively. Alcohol reduced them to 1.7, 4, 7.4, and 52.8, respectively, while ether still further reduced them, showing a loss of the peroxide in the times mentioned of 0, 1.3, 2.4, and 15.9, respectively.

— At the Royal Society *conversazione*, May 6, a great deal of interest was excited by the exhibition of sixty tools and utensils of the Roman period, found together in a pit in the Roman-British city of Silchester, Hants. These included an anvil, a pair of blacksmith's tongs, hammer, axes, gouges, chisels, adzes, a large carpenter's plane, two shoemaking anvils, two plough coulters, a standing lamp, a gridiron, a bronze scale beam, and others. Many of these articles were most remarkably like similar tools of the present day, the plane, which was evidently a "trying plane," and entirely of metal, being very suggestive of a Yankee origin. It is said to be the only Roman plane found in Britain. It would be interesting to know if this particular make of plane has ever been found elsewhere. It would seem as if the metal planes introduced the last few years are merely a reversion to an old type, a kind of atavism.

— Sixteen graves have recently been uncovered at Fort Ancient, the site of the greatest of the earthworks of the mound-builders. The excavation is under the auspices of the World's Fair, and under the direction of Professor F. W. Putnam of Harvard, the field work being in charge of Warren K. Moorehead. The skeletons disclosed were those of eleven men, one woman, and four children. Five were in a good state of preservation, the others in various stages of decay. In one grave the bones were so nearly gone as to preserve only the outline in crusted ashes. In another the skull alone remained, in the jaws of which were the well-polished teeth. The skeletons were those of men averaging five feet two inches in height, the tallest being six feet two inches. The burials were from three to five feet below the surface. The skeletons rested upon hard clay. Around them had been rudely set up flat river stones, then earth had been filled in, and over all broad flat stones placed. There are evidences that the men had died in conflict. About the neck of one of the child skeletons was found a necklace of bears' teeth, and in two or three of the graves were found tomahawks and stone hatchets, but no relics of an especial value. The graves will be reconstructed exactly as found for the World's Fair exhibit of American antiquities, except that no earth will be over the skeletons.

— The House of Representatives in the new Diet of Japan, says the London *Journal of Education*, is extremely anxious to cut down the Budget, and a conflict is imminent between it and the government on this subject. Its proposals are sweeping, and if carried out would cause no little consternation in the education department. The grant for schools would be reduced from $800,000 to about half that sum. Some five years since, the late Viscount Mori, who perished by an assassin's knife on the day of the declaration of the constitution, just two years ago, established five great higher middle schools, in different centres throughout the empire, to act as feeders for the university, and to serve as a check on the growing congestion of students in the capital. These institutions are specially threatened by the parliamentary reformers, many of whom hold Spencerian views, and dislike government control in education. Generally speaking, this is a critical time for education in Japan. The rising generation is growing up

without those habits of instinctive obedience and reverence which characterized the previous civilization, and the capable teachers are all young and comparatively untried men. The question how to preserve sound morality and discipline in the schools is causing grave concern at headquarters. There is a conservative movement at full flow just now, the demand for foreigners as teachers is at ebb, the schools in most cases preferring Japanese who can help them translate. Foreign modes have never been so unpopular since the great revolution. There is a troublesome class in the capital known as *soshi*, a word which it is difficult to translate so as to convey an adequate meaning. They are not students, though so described sometimes, but rather political unattached meddlers, who would right all wrongs by the use of sword-sticks and bombs. They profess to be intense patriots, and are certainly in many cases reckless of their lives, and most deliberate in carrying out their plans. The only school in which anything of the *soshi* spirit has appeared is the Higher Middle School of Tokyo, some of the students in which have once or twice disgraced themselves.

— In the new number of the Journal of the Bombay Natural History Society, says *Nature*, Lieut. H. E. Barnes continues his interesting papers on nesting in western India. Speaking of house-sparrows, he says that no amount of persecution seems to deter them from building in a place when they have once made up their minds to it. At Deesa he found that a pair had built a large nest in the antlers of a *sambur* in the veranda. Another pair made a nest in the soap-box in the bath-room, and, although the nest was destroyed several times, they would not desist, and at last, "from sheer pity," he had to leave them alone. The most peculiar case was when a pair had a nest in a bird-cage hanging against the wall, just above where the *durzi* sat all day working, and close to a door through which people were passing in and out continually. The door of the cage had been left open, the previous occupant having been transferred elsewhere. Not only were four eggs laid, but the nestlings were reared, although the cage was frequently taken down to be shown to visitors. Once the eggs were nearly lost, a boy having taken them out. The fuss made by the birds led to the recovery of the eggs. The author has a curious note on another peculiarity of sparrows. "I have often," he says, "had to turn the face of a looking-glass to the wall to prevent them from injuring themselves, for immediately one of them catches a glimpse of himself in it, he commences a furious onslaught on what he imagines must be a rival, and, if not prevented, will continue fighting the whole day, only leaving off when darkness sets in, recommencing the battle at dawn the next day. I once tried to see how long it would be before the bird gave in, but after two days, seeing no likelihood of his retiring from the unequal contest, I took pity on him and had the glass covered up. The bird did not seem in any way exhausted, although I do not think that he had a morsel of food for two days."

— From a report of Professor A. E. Dolbear, the electrician of the Portelectric Company, we learn that during the past year experiments have been carried on at the New England Portelectric Station in Dorchester, with the view of determining the best conditions for building and operating a commercial line employing the method known as the "Portelectric," to which we have before referred in *Science*. As the whole scheme was a new one, every step was a tentative one. The oval track is 2,784 feet long, and the curves are much too short to attain the high speeds attainable on a straight line. When the car was first sent round the track, it made the circuit in about two minutes; now it has made it in fifty-one seconds. The hindrances to still swifter travel are only the mechanical ones of proper track and alignment. That this is so is evident from the fact that an acceleration of six feet per second has been observed upon the iron car, which weighs about 500 pounds; an acceleration which if maintained for thirty seconds would give it a speed of 180 feet per second — a little more than two miles a minute. The friction of the present structure is therefore the only impediment; and it is equally obvious that the strap rails used, the lack of stiffness in the beam carrying the upper rail, and the severe wedging of the wheels as they go round the sharp curves are the factors. These, of course, can be entirely remedied. The experimental car is hollow, and has an interior capacity of about five cubic feet, and is therefore capable of holding about 10,000 letters, which would weigh 180 pounds; or the space could be filled with other packages needing transportation. It is probable that a still greater capacity in the car could be had with as great efficiency in power and speed. On account of the fact that the car closes its own circuit in the coil where it chances to be, it happens that numbers of cars can be running upon the same track at once, each one taking its supply of electrical energy independent of the rest. Suppose, then, a line between Boston and New York. If the speed be, say, two miles a minute, then, if a car left, every five minutes, they would be ten miles apart. If this rate of despatching a car be maintained for all-day service, there would be $12 \times 24 = 288$ cars one way per day, and if each one's load was, say, 250 pounds, they could transport thirty-six tons per day. If the track were double, as it probably would be, it could transport twice that amount.

— On the 7th of April last, says *The Missionary Herald*, the Harris School of Science at Kyōto, Japan, was opened and the Science Hall dedicated. The building is 110 by 65 feet, with a wing for a laboratory, and has connected with it an astronomical tower. The cost was about $15,000, which, with $85,000 for endowment, was the gift of an American, who desires that scientific instruction shall be conducted under Christian influences.

— Some remarkable electrical phenomena accompanying the production upon the large scale of solid carbon dioxide are described by Dr. Haussknecht of Berlin in a recent number of the *Berichte* of the German Chemical Society, of which *Nature* of May 14 gives a brief account. In order to obtain large quantities of solid carbonic acid it is found most convenient in practice to allow the liquid stored in the usual form of iron cylinder to escape into a stout canvas bag, best constructed of sail-cloth or some such strong fabric, instead of the usual lecture-room receiving apparatus, the cylinder being inclined from the vertical so as to permit of a ready and uniform exit from the opened valve. The liquid under these circumstances issues at pressures varying from sixty to eighty atmospheres, and a compact snow-like mass of solid carbon dioxide is formed in the canvass receiver, owing, as is well-known, to the extreme lowering of the temperature of the liquid due to its sudden expansion and the accompanying absorption of heat. When the experiment is performed in the dark, the canvas receiver is seen to be illuminated within by a pale greenish-violet light, and Dr. Haussknecht states that electric sparks ten to twenty centimetres long dart out from the pores of the cloth. If the hand is held in these sparks the usual pricking sensation is felt, similar to that perceived on touching the conductor of an electric machine at work. Dr. Haussknecht further states that the phenomenon is very noticeable in the dark whenever there is a leakage in any portion of the compressing apparatus or the manometers connected therewith. The reason assigned for this development of statical electricity is similar in principle to that usually accepted in explanation of the hydro-electric machine of Sir William Armstrong. As the liquid carbonic acid is issuing from the valve it becomes partly converted into gas, which is violently forced through every pore of the canvas. Moreover, carried along with this stream of gas are great quantities of minute globules of liquid, which are brought in forcible contact with the solid particles already deposited. Dr. Haussknecht therefore considers that the electrical excitation is due mainly to the violent friction between these liquid globules and the solid snow. It is very essential for the successful reproduction of these electrical phenomena that the carbon dioxide should be absolutely free from admixed air; that prepared artificially yielding much finer results than that obtained from natural waters, which latter contains considerable quantities of air. The luminosity is not generally developed in the interior of the receiver until a crust of solid carbonic acid from one-half to one centimetre thick has been deposited, which renders the probability of the correctness of the above theory all the greater. Dr. Haussknecht has constructed a special form of apparatus, with which he is now experimenting, with the view of being able to determine the sign, nature, and quantity of the generated electricity.

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DISCOVERY OF A FRESH-WATER LAKE NEAR THE SEA OF ARAL.

ACCORDING to information conveyed to the Geographical Society of Paris by M. Edouard Blanc, and printed in the May number of the Proceedings of the Royal Geographical Society of London, an interesting discovery of a fresh-water lake to the south-west of the Sea of Aral has been made by Col. Koslowski, of the Russian geographical service of Turkestan. Up to a comparatively recent date the Sea of Aral was represented on the maps as forming at its south-west corner a deep, narrow gulf (named Aïbu-ghir), extending far into the land, and bordering on the south-east the great Ust-Urt plateau. The Russian military expedition to Khiva (1872–3), in its march round the south-west and south of the Sea of Aral, found no such arm of the sea, and since then the Gulf of Aïbu-ghir has practically disappeared from the maps. In the map which accompanies Baron Kaulbars' work on the delta of the Amu-daria, the so-called Gulf of Aïbu-ghir is shown merely as a depression, without water, and its form and position are only vaguely indicated. Recent surveys effected by Col. Koslowski have revealed the existence of a fresh-water lake, occupying very nearly the position formerly assigned to the Gulf of Aïbu-ghir, but differing in its form. This lake is quite distinct from Lake Sari Kamish, which lies to the south of the table-land of the Ust-Urt, and has recently been the subject of a special exploration by Gen. Glukhovskoi. Unlike the Sari-Kamish depression, which, except at times of great overflows of the Oxus, is mostly dry, Lake Aïbu-ghir has a permanent supply of water, being fed by a fresh-water stream flowing into it from the north-east, which, although not in direct communication with any branch of the Amu-daria, drains the marshes formed by the overflowing of that river. The probable explanation of the formation of this lake is, according to M. Blanc, that it is part of the former great Aralian basin, which has become isolated in consequence of the general and progressive desiccation which has taken place in all this region. The elimination of the salt from its waters might be due to the formation of salines, although no salt-beds under the sand round the shores of the lake have yet been discovered; or it might be supposed that at some recent epoch, during a great overflow of the Oxus, the lake basin was filled with fresh water, the salt water being driven back into the Sea of Aral, and that at the same time a bar was formed by the alluvium brought down by the river, which would prevent the salt water flowing back again into the lake. The map of Col. Koslowski also fixes definitively the contour of the south-eastern escarpment of the Ust-Urt plateau and the topography of the country to the south-west of the Sea of Aral.

IMMORTALITY IN THE LIGHT OF MODERN DYNAMICS.[1]

THE hypothesis in reference to the re-grouping of atoms, in accordance with the calculus of permutations, which I announced in conclusion of my lecture on "Geological and Cosmical Problems," before the Franklin Institute, on November 17, 1890, is not entirely new, and I am bound to say that in at least one of its aspects it was advanced more than a hundred years ago by the great German philosopher Leibnitz, at a time when the sciences of chemistry and physics were not sufficiently advanced to warrant such a speculation. In the light of modern dynamics, however, it deserves our closest attention, for if it can be shown that matter is composed of ultimate particles, call them atoms, centres of force, or what we like, which are indestructible and in a state of continual vibration, I do not see how we can escape the conclusions which are forced upon us by this hypothesis. Some of the points which I am now about to discuss are new, and I am not aware that this entire subject has ever been presented in the manner in which I now propose to deal with it.

According to the nebular hypothesis our earth, like all the rest of the planets, once existed in the shape of a gas-ring, which was thrown off or became detached from the sun during its process of condensation. This ring could not retain its form: it necessarily went to pieces, and these afterwards collected into a single gas-globe, or spherical mass, which kept on pursuing its course around the great central body. The gaseous globe radiated an enormous amount of heat, it grew denser and denser, while its diameter diminished; it underwent an endless series of metaphorphoses, until it finally became the earth as we know it, the planet which has given us birth. So far all this is nothing new.

Now, even if the nebular hypothesis should prove erroneous, the conclusions which I am now about to present will remain in force, for the same ultimate conclusions can be drawn from every other world-hypothesis which has, as yet, been advanced.

Every particle of our earth, every object, every substance which we now have upon or in our earth, must have already existed in that gaseous ring or primitive gas-globe: no matter in what form or condition, it was there. In that gas-globe were the particles which, after countless ages, became united and roamed the great Mississippi valley in the shape of a mastodon; in that globe of gas were the atoms of carbon which now constitute the table on which I am writing these lines; in that immense rotating sphere were the substances which are now united in the body of my humble self.

Could we but follow, in a few days or hours, the changes, the transformations, the endless pilgrimages, which the atoms and molecules of the substances had to undergo during those æons before they became united so as to form, for instance, a human body, what marvels would we behold? The particles of hydrogen, carbon, phosphorus, etc., of which my body is composed, what a history might they not tell? In how many other bodies of the human species, of animals, plants, and inorganic compounds may they not already have existed, separated, united, differently grouped or arranged? What may they not already have gone through and experienced?

If King Solomon, wise king though he was, really pronounced, or was the first to pronounce, the opinion that there is nothing new under the sun, he could not possibly have been aware of the enormous significance which attaches to this idea in the light of modern science. Why should not the dust of Cæsar which is now filling a bung-hole, why should not those atoms and molecules which two thousand years ago were united in the body of Cæsar,—why should they not, after endless transformations, endless changes, endless transitions, become again united in precisely the same manner; in other words, why should not the same Cæsar of whom we read in ancient history, reappear at a given time: in short, why should not every thing now existing be compelled to undergo the same cycle of changes, and reappear, not once, but an infinite number of times? It would be very strange if such were not the case. The following will illustrate this.

Supposing we were to take six dice, such as are used in the

[1] Addendum to a paper on "The Limits of Scientific Inquiry" read before the Franklin Institute, Philadelphia, Nov. 17, 1890, by Dr. H. Hansoldt of Columbia College.

ordinary game. Let us place them in a little box, shake them, and throw them on the table. We will assume that they had fallen so that each cube exhibited the number three on its upper face; of course, a rare chance. Now it can be mathematically shown after how many throws those six numbers are likely to reappear according to the law of chance. It is possible that they may turn up already with the next throw; on the other hand, we may have to cast those dice ten thousand times. Both cases are improbable: the probability lies in a certain number. If, instead of six dice, we were to take seven, the critical number is, of course, so much further removed, viz: it would be necessary to throw oftener to get the seven threes, and so the number of casts increases with every additional cube, till we finally obtain enormous figures. But no matter how many dice, the threes must turn up, if we can throw them long enough, and if, in the case of a thousand dice, it were to take a million years, the threes must appear and reappear again and again after proportionate intervals.

Supposing now, that, instead of dice, we were to take a glass filled with sand. There are, let us assume, twenty thousand sand grains in the glass. Each particular grain occupies a certain position, which is bound to differ from that of all the rest of the sand grains: this the reader will doubtless admit. We shake the glass; the positions are altered, the order of arrangement is disturbed. We shake it again; the sand grains are now in a totally different position. We continue shaking the glass, and the time must come when each individual grain again occupies the exact position which it occupied when we originally started. It is a mathematical necessity, which all will admit who know anything of the calculus of permutations. The twenty thousand sand grains may be looked upon as so many dice, which are bound to fall precisely as they once fell if we can throw them sufficiently often.

Now, I have strong grounds for assuming that my body is composed of atoms, or groups of atoms, of a limited number of elementary substances, or of one elementary substance, if all matter has been evolved from one primary element. The number of these atoms may be ever so great, it has nothing whatever to do with the inevitable result. I know also that all other bodies are composed of such atoms, or groups of atoms (molecules); not only those of the human species, animals, and plants, but of inorganic substances, rocks, metals, fluids, gases; in short, of every thing which exists in, upon, or above the ground in the atmosphere. I know, furthermore, that the atoms of even the hardest and seemingly most enduring substances, such as agate and diamond, are in a state of continual vibration; that nothing can permanently retain its form; that the entire universe always has been, is now, and always will be, in a state of metaphorphosis or continual change.

The time must arrive when the atoms or molecules which are now united in my body, after countless transformations and wanderings through all kinds of bodies, substances, or intermediary stages, will once more unite in the same manner; in other words, the time will arrive when my life, like that of every other individual, will repeat itself. Yes, repeat itself, and not merely once, but an infinite number of times.

And more than this, if one of my readers should imagine that the atoms or molecules which now constitute his body, are thus associated for the first time, I can only admire his simplicity. There is nothing new under the sun. Those molecules were united in this manner before, and before this again, and 100,000,000 times previously, as far as our imagination can carry us back into the abysmal night of the æons of the past. In other words, each of my readers has been, ages ago, what he is now, has lived and gone through all this before, has felt and experienced what he now feels and experiences, down to the minutest details, has opened his *Journal of the Franklin Institute* billions of years ago and read the same lines; not once, but an endless number of times. The recollection, of course, is lost. Life and mind itself, consciousness, or "soul," is only a product of matter, and if the same substances reunite in the same manner, the same phenomena must inevitably recur.

Let the molecules which now constitute my body undergo ever so many metamorphoses, let them even — which, of course, is very improbable — once fill a bung-hole, let them be scattered about in all manner of forms and conditions, in close contact or millions of miles apart; they must come together again, may the thought please or distress me, — this is the iron logic of modern dynamics.

A JOURNEY IN COSTA RICA.

AT the February meeting of the Geographical Society of Paris (reported in the Proceedings of the Royal Geographical Society, London) a letter was read from M. H. Pittier, head of the Physico-Geographical Institute of Costa Rica. His route lay through country not previously explored from a scientific point of view. At a distance of several leagues from the capital, the traveller entered the region of oaks, which he hardly quitted for a whole week. The whole of the district known under the name of Candelaria, which, at the time of Œrsted's visit, was well wooded and rich in interesting plants, has become denuded of vegetation through the carelessness of the inhabitants, and is to-day partly covered with a poor kind of turf, over which are scattered clumps of the fragrant bushes of the "tuete" (*Vernonia brachiata*). Beyond the Rio Tarrazu the character of the country changes, and the road ascends in a zigzag line the mountain slopes, covered with forests of virgin oaks. On the summit of the Cordillera the "Paramo del Abejonal," the vast prairie which occupies the ridge of the mountain is crossed, and then a rapid descent was made to San Marcos. From the latter place to the valley of the Rio General is a journey of five days, across the great mountain of Buena Vista, the geographical importance of which has, according to M. Pittier, been overlooked, owing to insufficient exploration. Although inferior in height to the peaks of Irazu and Turialba, Buena Vista presents more sudden changes of climate and a greater variety of vegetation. The summits are almost continuously swept by a keen, strong wind, which condenses thick mists. Sleet falls frequently, and a white frost forms when the nights are clear. The immense forests, which clothe its flanks up to a great altitude, are formed almost exclusively of oaks, among which the most frequent varieties are the *Weinmannia glabra* and the *Drymis Winteri*. The vegetation of the upper region, above the forests, is alpine in character, but the bamboos were found growing beside representatives of an evidently northern flora. At one point, clearly defined formations of columnar basalt were noted. This, with other indications, led the traveller to the conclusion that the whole of the Cerro de Buena Vista is of eruptive origin, although no traces of former volcanoes were descovered. The mountain is important from a hydrographical point of view. The head waters of the Rio Reventazin occupy the greater part of its northern slope; on the west it feeds the Rios Parrita Grande, Naranjo, Savegre, and Baru; while the various branches of the Rio General take their origin from its southern flank. M. Pittier intended to cross the immense forest-covered plains extending on the left bank of the Rio General as far as the Indian villages of Terrata and Boruca, and to return to San José at the end of February. He states that the maps of all this part of Costa Rica are very faulty.

HIGH WINDS AND BAROMETRIC PRESSURE.

THE relation of high winds to barometric pressure, from observations carried out at the Ben Nevis Observatory, was the subject of a paper from Dr. Alexander Buchan, at a meeting of the Royal Society of Edinburgh on March 2, 1891, an abstract of which is given in the *Scottish Geographical Magazine* for May. This was a question, Dr. Buchan said, which had been much discussed in recent years, — some meteorologists maintaining that the influence of high winds was to depress the barometer, others that it was to raise the barometer, and several others, again, that it had practically no effect whatever. In the discussion of the Ben Nevis observations, particularly from the time that hourly observations began to be obtained from the low-level observatory at Fort William, in July last, the first question that appeared to him calling for thorough investigation was this question of the relation of the winds to the readings of the barometer, inasmuch as, till this relation be approximately determined, the proper discussion of

nearly the whole of the observations cannot be satisfactorily proceeded with. This arose from the manifest disturbing influence of high winds upon the readings of the barometer at the top of the Ben. Since the two observatories are only about four miles apart in horizontal distance they are virtually one observatory as regards geographical distribution of pressure; and as the observatory at the top was peculiarly exposed to high winds, the violence of many of which those living on the lower levels could really form no conception, while the low-level observatory at Fort William was much sheltered from winds, the two presented conditions for an exact determination of the question of the influence of winds on the barometer, from data which had not hitherto been available.

The observations at the top were made on Beaufort's wind-scale, ranging from 0, representing the calms, to 12, the greatest hurricane likely to occur. These observations had been carefully compared in connection with the registrations of a modification of Robinson's anemometer, which had been specially constructed by Professor Chrystal to meet the exigencies of observing at the top of the Ben. An elaborate comparison had been communicated by Mr. Omond to a meeting of the Royal Society some time ago, in a paper in which he had arrived at the equivalent in miles per hour for each degree of Beaufort's scale.

The next step followed in the present inquiry was to reduce the observation at both observatories to sea-level, and thereafter to enter the differences between the two barometers in columns headed 0, 1, 2, etc., of Beaufort's scale. This had been done for the six months ending January last; and as it was desirable to increase the number of observations at the higher velocities in order to obtain good averages, the observations made five times daily at Fort William from the beginning of 1885 were compared with those made at the same hours at the top of the Ben, when the wind was at 5 and other velocities up to 11. From these results monthly averages of deviations of the two barometers were deduced, with the result that in all cases a reduced barometer for the top of the hill read lower than that at Fort William, and the amount is proportioned to the force of the wind. Thus, in calm weather the Ben Nevis barometer was only one one-thousandth of an inch lower than that of Fort William, and as the velocity of the wind increased, the depression gradually became greater up to force 4, when it was fourteen one-thousandths lower. From this point it more rapidly increased, till at force 7 the depression was half the tenth of an inch; at force 9, fully the tenth of an inch; and at force 11, a tenth and a half of an inch. These differences, being exhibited in a diagram, showed a remarkable curve of depression corresponding with increased velocity of wind.

The results, Dr. Buchan pointed out, might be put to important uses in meteorology, particularly in endeavoring to establish the relation between the barometric gradient and wind velocity in storms. Hitherto this relation had been attempted to be established from the results as observed, though, it had to be confessed, with not very satisfactory results. Now, however, by applying corrections in accordance with what had been arrived at, this important practical question in meteorology could be attacked with good hopes of success. Dr. Buchan further pointed out, that, as regarded the mean distribution of pressure over the British Isles, the lower pressure hitherto determined at places on the west coast peculiarly exposed to strong winds and storms might be due, not so much to a natural depression of the barometer in these regions, as to the lowering of the barometer by the wind force that swept past the stations where the observations were being made.

HOUSEHOLD REFUSE.[1]

THERE are 750,000 tons of household refuse produced in London every year, and the vestries are at their wits' ends to know how to dispose of it. There is a tradition that large fortunes were once made by dealing with such waste, and the "golden dustman" has passed into a proverb. But if ever this was the case, it has long ceased to be so. Either the quality of the dust has changed, or the former means of dealing with it have ceased to exist, as now it is a source of expense from first to last, and the object of all concerned in its removal is to get rid of it as rapidly and cheaply as possible.

At one time the "destructor" opened a prospect which was full of hope to the parish officials, and they grasped at the idea of burning up all the foul rubbish, and thus getting rid of it once and for all. But that time has passed. The suggestion of establishing a destructor in a district sets all the inhabitants into arms, and gives rise to an outcry that cannot be resisted. In theory the incineration of refuse is beautiful, and it can be carried out fairly well in practice, so long as the apparatus works under favorable conditions. But somehow a breakdown occurs every now and then, and the stink of burning animal refuse pervades the neighborhood. It is very easy to see how this may occur if the fires are allowed to get into bad condition. The collecting vans come in irregularly; sometimes several may arrive together, and, if the men tip their damp contents one after another into the furnaces, there is a great probability of the fires being checked and a volume of smoke given off that does not get completely consumed by the appliances provided for the purpose. Much of the evil may be due to carelessness or want of management, but whatever may be the cause, the destructor has earned for itself a bad name with the public, and it is almost impossible to establish one within the precincts of a town.

The plan that was formerly adopted of laying the refuse, or "dust" as it is called, in heaps and sorting it by female labor, requires a considerable amount of space and gives rise to nuisance. The contents of the heaps, shut out from air and light, putrefy, and when they are turned over, the stench spreads far beyond the limits of the ground. In small places this method is still pursued, but it is no longer practicable in large towns. Such places seek the readiest way of getting the dust right away. If they have access to the sea, they take it a few miles out and dump it into the water, with the result that a good deal of it floats back and litters, if it does not defile, the shore. The London vestries discharge their vans into barges and send the contents down the river to be laid on the Essex and Kentish marshes. Here there is abundant fresh air and only a spare population, so that no harm is done. In course of time nature disintegrates most of the elements of the heterogeneous mass, and when mixed with the vegetable mould of the marshes it becomes a fairly productive soil.

A cursory inspection of the contents of a dust-cart leads to the idea that they are mostly valueless and wholly offensive, or capable of becoming offensive under the influence of time and heat. But this is a mistake, due to the large bulk of the lighter and more ordurous constituents. Such articles as empty meat tins, bottles, waste paper and straw, and vegetable refuse, make a large bulk, but only weigh very little. Three-fourths of the weight of the dust collected consists of fuel. A proportion of this has never been on the fire, while most of the remainder is good cinder; it has had the gases expelled, but the carbon remains and makes capital fuel. Of course there is some thoroughly burned ash, but it is wonderful how much less than one would expect to find. The modern servant is not addicted to the use of the riddle, and all she finds in the grate in the morning goes into the dustbin. This is well known to those interested in such matters, and the brickmakers consequently absorb many thousands of tons of breeze from the dust-carts annually, to the great annoyance of their neighbors; for, although the amount of animal and vegetable refuse is relatively small, it is usually sufficient to taint all the other elements in the dust, and to render them offensive when burnt or handled.

It has been the object of sanitary reformers to discover a method by which the valuable part of the dust could be thoroughly cleaned and turned to account, and the useless parts destroyed without nuisance. A process devised for this purpose is now to be seen in active operation on the premises of the Refuse Disposal Company, Chelsea. It is the invention of Mr. Joseph Russell and Mr. J. C. Stanley, and its salient feature is that the dust is dealt with immediately it arrives, and that, during the whole time it is under treatment, it is kept in motion, and is fully exposed to the air in thin layers. It is tipped from the cart into the machine, and immediately commences its passage through the various sorting devices. In a few moments it has been divided into its different constituents, while all that is offensive has been intimately ground up with

[1] Abstract of an article in Engineering of May 15.

other material, mostly carbon, in which it is not only lost, but deodorized. The breeze and ashes find a ready sale among the brickmakers, but there is still a better outlet for them. By mixing them with pitch they can be pressed into briquettes and used for steam raising. It can scarcely be contended that these briquettes are equal to those made from fresh Welsh coal, but they are very fair, and can be sold at a reasonable price. The liquid pitch incloses any objectionable elements they may contain, and the result is that they are inodorous. Another material of value found among dust is paper. Immense quantities of this are collected, and can be used over again for the manufacture of common brown paper for wrapping parcels. After being dried to remove the dust, and passed through the beaters to reduce it to pulp, it becomes as clean and as sweet as when it came home from the grocer's or draper's. Straw can be similarly utilized for strawboards.

We recently had an opportunity of inspecting the company's premises, and feel sure that a short account of them will interest our readers. It is an important feature of the process that it is almost entirely mechanical, as nine-tenths of the material is never touched by hand. The dust as it arrives is tipped into a rotating cylindrical sieve. This runs on a horizontal axis, and is twelve feet in diameter by twelve feet long. The meshes are formed of bars three inches apart, and the progress of the tailings is regulated by an internal worm, which obliges them to make about three circuits of the screen before they can escape. A large exhaust pipe, operated by a powerful fan, draws all the floating dust and small particles forwards, and delivers them into the closed ashpit of a steam boiler. The tailings are mostly bulky articles; the paper, rags, and straw usually roll into balls, although a good deal of small escapes through the meshes. Each thing that comes out is thrown on to its proper heap, while the rubbish for which no use can be found is sent to be ground under edge runners, as will be explained presently.

The articles that pass through the meshes are raised by an elevator, and delivered to a second rotating screen fifteen feet long, six feet in diameter, and an inch and a half mesh. The tailings from this are first subjected to a blast, to take out light paper and straw, and are then dropped on to a revolving sorting table, fifteen feet in diameter. A boy sits beside it, and picks out every thing of value as it passes him, such as bottles, glass, iron, bones, etc. The rubbish, such as animal and vegetable refuse and broken crockery, he allows to go past him to the grinding mill. Here every thing for which no use can be found is reduced to a dry powder, which appears able to absorb all the offensive elements and render them sweet. There are no heaps labelled "miscellaneous" in these works to distract the manager and breed a nuisance. Every thing that is doubtful goes into the mill, which is the *pot au feu* of the establishment. When it comes out it is no longer recognizable. The mixture is carried back and put into the first screen to be again sorted.

Every thing that will pass through an inch and a half mesh falls from the second screen on to a travelling band, which delivers into a third screen fifteen feet by six feet, covered with two meshes, half an inch and three-eighths of an inch. What passes through the former is called ashes, and through the latter breeze. The tails go for steam generating. The ashes are used to mix with clay for brickmaking, and the breeze for burning in the clamps, unless, as indicated above, they are pressed into briquettes, which, of course, fetch a better price. The ashes and breeze pass over a fine shaking-screen, which takes out every thing below an eighth of an inch. This is valuable as manure, being the greater part of the animal and vegetable matter ground up in the mill.

Having traced the dust through its entire passage we must return and notice some of the tailings. As we have already said, every thing for which an immediate use cannot be found is destroyed. At present straw falls into this category, although the success of foreigners in the manufacture of straw-boards leads to the hope that that manufacture may be eventually established here. The straw is all burnt with special precautions to render the smoke inoffensive. An externally fired cylindrical boiler has two grates; on the larger of these the straw is burned, while on the smaller there is a breeze fire through which the gases from the straw are passed to complete the combustion. The paper is re-made on the premises. This seems a curious industry to carry on in Chelsea, but a well has been sunk into the gravel, and an ample supply of water has been obtained to keep three beaters and one paper machine at work. This is the most valuable by-product of all. The special value of the process is, however, that it enables the paper to be cleansed immediately, instead of being retained until a market can be found for it.

The works naturally consume a good deal of steam, particularly for the paper-making, and this accounts for much of the fine fuel. Indeed, it is conceivable that in any general extension of the system it might be worth while to use all the fuel on the premises in winter for the production of electric lighting currents. The total cost of handling would thus be avoided, and possibly a saving of the ratepayers' money effected. To prevent the evolution of smoke and any nuisance that might arise from the nature of the fuel, the five boilers of the works have their smoke drawn by an exhaust fan through scrubbers, in which it is thoroughly washed before it is delivered into the air. The three locomotive boilers are worked with forced draught, by which all the floating dust collected from various parts of the works is thoroughly burned up.

The works have already been in operation for nearly two years, and during that time they have grown up to the present state as the results of prolonged experiments, in the course of which five thousand loads have been treated. Difficulties, often quite unexpected, have been found and met, and new devices have had to be produced as time went on. At present the works are dealing with thirty-five loads a day from Kensington and Westminster parishes, and are on a sufficiently extensive scale to show what the process will do. They are exciting a great amount of attention all over the country, and many parishes are watching them with interest. The disposal of dust is undoubtedly one of the greatest problems of the day, and the process patented by the Refuse Disposal Company solves the question from a sanitary point of view, but of course it would want an examination of their books to decide the exact economic value of the process.

HEALTH MATTERS.

Pathogeny of Diabetes.

BOUCHARD has stated that there are no fewer than twenty-seven theories of the cause of diabetes. None are entirely satisfactory. The most important fact discovered in recent years, says the *British Medical Journal*, is that diabetes follows extirpation of the pancreas in animals, and numerous clinical observers have since then noted pancreatic disease in conjunction with glycosuria. V. Mering and Minkowski, with most praiseworthy scientific reserve, have abstained from formulating any theory to explain the undoubted fact they have put upon record, and Lépine has discovered an additional fact in relation to pancreatic extirpation and diabetes, which must be taken into account when the true explanation of these phenomena is forthcoming. Healthy blood possesses what he terms glycolytic powers. Fresh blood contains a certain percentage of sugar. If the same blood be allowed to stand at the body temperature for an hour before it is examined, a very considerable portion (20 to 40 per cent) of this sugar has disappeared. This number (20 to 40) may be taken as the glycolytic power of healthy blood.

It is considered that this sugar-destroying power is due to a ferment present in the corpuscles, but especially in the white corpuscles, as the glycolytic power of the chyle is as great as that of the blood, and the portions of the blood richest in leucocytes are richest in the ferment, which may be dissolved out from them by salt solution. In cases of diabetes the glycolytic power of the blood falls to 5, 2, or even 1. In animals without a pancreas there is a similar drop. The pancreas thus appears to be the chief source of the ferment.

Lépine believes that the activity of a pancreatic cell is bipolar; by its internal extremity it pours the pancreatic juice into the ducts of the organ, and by its basal extremity it pours into the venous blood and lymph the glycolytic ferment. The absence or

diminution of the sugar-destroying power of the blood dependent on pancreatic extirpation or disease is thus a factor, and perhaps an important one, in the causation of an over-abundance of sugar in the blood, and will certainly have to be reckoned with before the true pathogeny of diabetes is understood.

Effects of Tuberculine on Monkeys.

M. Henocque has recently tried the effect of tuberculine on a monkey which presented no symptoms of pulmonary phthisis. Two days after the first injection, according to the *British Medical Journal*, the animal, which had exhibited the characteristic re-action, presented dullness and a few *râles* at the right apex. After the third injection the dullness was more marked on the right side, and began to be perceptible at the left apex. Soon all the symptoms of acute phthisis manifested themselves, with intense fever, the animal dying ten days after the last injection, after losing a tenth of its weight during that time. The total amount used was six milligrammes of the diluted fluid. On post-mortem examination, four tuberculous nodules of the size of a pea were found in the right lung, and caseous pneumonia involving two-thirds of the organ in the left. In both cases the tuberculous lesions were surrounded by a zone of very intense red hepatization. Pieces of the caseous tissues were injected into two guinea-pigs, in one after mixture with sterilized water, in the other with diluted tuberculine. Both animals showed signs of cutaneous and glandular tuberculosis.

A New Antiseptic.

At the Académie de Médecine, Paris, on April 28, M. Polaillon read a paper contributed by Dr. Berlioz of Grenoble on a new antiseptic agent called "microcidine," which is composed of seventy-five per cent of naphtholate of sodium and twenty-five per cent of naphol and and phenyl compounds. According to the *Lancet*, it is a white powder obtained by adding to fused β-naphthol half its weight of caustic soda, and allowing the mixture to cool. It is soluble in three parts of water, and the solution, which is cheap, is said to possess considerable antiseptic powers, without being toxic or caustic, or injurious to instruments or linen. The antiseptic properties of microcidine, while inferior to those of corrosive sublimate or naphthol, surpass those of carbolic and boracic acids ten and twenty times, respectively. Microcidine is eliminated by the kidneys, and is antipyretic. M. Polaillon has experimented with this new agent largely as a dressing to recent and other wounds, utilizing as a dressing, after a preliminary cleansing of the raw surface with a three per cent solution, gauze soaked in the same and covered with a layer of oil silk and a thick pad of cotton-wool. The results are reported to have been excellent.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Electric Storms and Tornadoes in France on Aug. 18 and 19, 1890.

ON the very day of the tornado at Wilkesbarre, Penn., last year, another, almost unprecedented, was raging at St. Claude, France, near the Swiss frontier, south-east from Paris. On the previous day electric storms and very strong wind-rushes, perhaps tornadic in their character, devasted other portions of France. In the reports of these violent storms there is a continual mention of their similarity to the tornadoes in this country. Quite full accounts by several prominent physicists have appeared in *Comptes Reudus*, and these will be freely quoted from.

On Aug. 18, 1890, at 7.15 P.M., a *trombe* (this word is used for water-spout usually, and seems to indicate, on land, a funnel cloud but of somewhat narrower dimensions than those in this country) struck the commune of Piré, situated in Ille-et-Vilaine, and about 180 miles a little south of west of Paris. It moved to the north-east, and next struck Domagné, 3.5 miles from Piré. The length of its track was about 10 miles, and width 650 to 870 yards. Its velocity was almost 37 miles per hour.

A second *trombe* struck Dreux, situated 45 miles west of Paris, at 10.25 P.M.; then it passed north-east to St. Thibault, and on through the Blaise valley to Fontaine, about one mile from Dreux, It then turned to the left in the valley of the Eure River, and again turning to its former course, it struck Brissard.

On the next day a *trombe* struck St. Claude, at the eastern boundary of France, at 7.37 P.M. It moved north-east 15.5 miles to Brassus, then to Bris-d'Amont, and to the station Croy, which it reached at 8.37 P.M. The velocity was 42 miles per hour, and the width of destruction 220 to 1,100 yards.

These facts show clearly that there were several violent storms on the 18th running in parallel lines, beginning toward the west early in the evening and occurring at points farther east later on; that is to say, the several appearances near Piré and Dreux were separate occurrences, and the violent storm did not go from one to the other, but each devastated its own narrow strip. It will be seen that this bears a most remarkable resemblance to the action of tornadoes in this country.

At Piré the *trombe* was investigated by M. G. Jeannel. There was an apparent whirlwind, transported parallel to itself, and turning counter-clock-wise, as shown by the fallen trees. The first thrown down were from the south-east, the next from the east, and so on to the north-west. The greater damage was on the right hand of the track. The velocity of gyration was great and that of translation relatively much less.

The roofs damaged were peculiar. On the right of the path those facing north were carried away, while those facing south were unharmed; on the left of the track just the reverse was true. During the whole time the lightning was continuous. The odor of ozone was noted at different places. At Reinou a woman tending a cow, grazing in the meadow, saw her enveloped in violet flames. These were so intense that the woman, from fright, covered her face with her handkerchief. A moment later the wind struck down every thing.

At Domagné Dr. Pettier suddenly heard an extraordinary indefinite roaring. He rushed toward the garden, where the firs were being plucked up. At the gate he felt a kind of pressure from above; he noticed an unusual smell of ozone; then he felt himself raised up, and this not by the wind, for it was calm, but as though by some invisible force. On many trees the foliage was scorched. About a mile west of Domagné, hail of the size of a walnut fell to a depth of over three inches, covering the ground.

At Dreux the report was by M. Bort. At 10 P.M. a great cumulo-nimbus thunder-cloud was seen to the south-south-west of the town. On its upper part a very brilliant plume of sparks was directed toward heaven. In this cloud the lightning was incessant and the thunder loud. After some hail had fallen, at about 10.25 P.M., a loud roar was heard, like that of a train entering a tunnel, and in less than a minute the storm reached the town. It blew off the tiles, plucked out the trees, and destroyed many houses. At the moment of the passage the sky was on fire, and some persons saw a cloud which reached the height of a house. Reaching the Blaise valley it plucked up many poplars, and left them lying generally from south-south-west to north-north-east. In the environs of Fontaine many trees were uprooted. At Brissard the hurricane made a passage through the western part of the village, destroying twenty houses. At another point most of the trees lay from south-west to north-east, but there were many, 220 yards from the first, that lay in an opposite direction.

Lightning strokes were very rare, because no traces were found upon trees, and no houses were fired. There was a remarkable exception, however, in the Vivien house, built solidly of brick, which had traces of electric discharges. Some window-panes were pierced by circular holes, and these holes had a sharp edge on the outside. On the inside the edge had suffered a beginning of fusion, which had rounded it off. The damage was reported at $300,000 in Dreux, and one person was killed. At the instant of the passage all the gas-lights were extinguished, and it is suggested that "this indicated a rarefaction of the air near the centre of the whirl." By the synoptic charts it appears that the passage of this *trombe* was coincident with the existence of a secondary

barometric depression in the west of France, its path being recognized from Vendir to Ardennes.

The tornado at St. Claude, on the 19th, was studied by M. Cadenat. The giratory movement was recognized by prostrate trees, by pieces of board, *débris* of roofs, etc. On the right of the track many trees were blown down toward the north-east. On the left less trees were uprooted, and some lay in an opposite direction. In some places trees were blown down at right angles to the track, their roots invariably to the right. At some places bunches of trees were left intact in the centre of the tornado's track. The whirl was counter-clock-wise. "This trombe-cyclone in its narrowness furnishes the character of a *trombe* or tornado, and in its whirling, of a cyclone. I give the following secondary phenomena in the order of importance:—

"(1) The liberation of considerable electricity.

"(2) The straight currents.

"(3) The division of the principal branch.

"(4) The funnel-shaped cloud.

"(5) The aspiration.

"(6) The lateral wind."

"At 8 P.M. the sky is like a vast conflagration; the air is calm. Some great drops of rain, some few hail-stones, very great (40 grams), formed of agglomerated grains, preceded the disaster. A lightning stroke fired a house at Bois d'Amont (Jura). At the Swiss frontier the people saw fire on all sides. At another place globular lightning was seen. Some people were killed by lightning strokes. On all sides was a smell of ozone. Walls were prostrated, holes bored in window-panes, stoves destroyed, keys and bars of iron twisted, etc. On all sides thunder-bolts were very evident from their mechanical effects.

"We see on the left and right of the track through a forest, and in front of each point struck by a thunder-bolt, trees thrown down in great number, the top directed against (*contre*) the point struck. The direction of some fir-trees was perpendicular to the path.

"The funnel-cloud, thanks to numerous and intense lightnings, was seen by an observer at Aigh, some 35 miles from the tornado. The aspiration produced by the whirl was shown by the transport to 300 and more yards of great and solid *vachers*, by the removal of roofs, by the plucking up of a heavy boundary-stone weighing a hundred pounds, by the transport of objects 31 miles, mostly to the north. Hail fell at more than two miles to the north-west."

M. Faye also received a private report from M. Cadenat, and remarks: "It is very remarkable that in the United States tornadoes are rarely accompanied by electric balls similar to those at Dreux or at St. Claude, or at the ancient tornadoes of Assonval (1822) and of Chatenay (1835)." He thinks this is because they occur here mostly in daylight. He also suggests that the mechanical action of tornadoes is well understood to-day.

I note (1) there seems to be an enormous variety of terms which are applied in France to phenomena of this kind. In the four reports, covering eleven pages, the following are noted: *coup de vent*, used 6 times; *cyclone*, 6; *meteor*, 11; *orage*, 13; *ouragan*, 9; *tempete*, 4; *tourbillon*, 12; *tourmente*, 1; *tornado*, 19; *trombe*, 13; *trombe-cyclone*, 2. The fact that "tornado" heads the list in frequency is significant.

(2) It is hardly probable that there was a diminution in the gas pressure at Dreux through a diminished air pressure. A similar fact was noted at Cleveland, O., when there was no tornado, and at Louisville, Ky., during the tornado last year. An investigation of this question has shown that the diminished pressure is due to the forcing of the gas-holder at the works, by the wind, against the upright posts (see "The Tornado," p. 136).

(3) It is hardly probable that the absence of the observation of fire-balls in the tornadoes in this country is due to the light of day hiding the appearance. At such a time the sky is black, and the light is sufficiently diminished to show any bright, fiery object. The lack of this observation is due, partly to its not having been investigated, partly to the fact that most every one seeks safety in a cellar or dug-out, where it cannot be observed, but mostly, I think, because in the severer tornadoes the electric action, while abundant, does not manifest itself in this way. We are but just beginning to learn about unusual manifestations of electricity in storm phenomena. One of the most recent utterances is this, regarding the action of a lightning flash: "The seat of the electrical energy is, and must be, not in the cloud or in the earth, just preceding a flash of lightning, but in the air column between cloud and earth" (*American Meteorological Journal*, April, 1891, p. 599). If it can be once proved that it is possible to intensely electrify a column of air, we shall have gone a long way toward determining the cause of our funnel-clouds and the destructiveness of the tornado. It should be noted that fire-balls were observed at Louisville ("The Tornado," p. 134).

(4) I think we have hardly made a beginning in a determination of the causes of the mechanical effects noted either in our general storms or tornadoes. I can do no better than close with a quotation from "Bay of Bengal Cyclone Memoirs, Part III.," just received in this country.

The author, Mr. Eliot, himself an ardent supporter of the ordinary condensation theory of storms and tornadoes, by a course of reasoning almost identical with that previously adopted in this country, has arrived at the following conclusion, on page 285:—

"A cyclonic circulation cannot be resolved into the translation of a rotating disk or mass of air. The fact that the main supply of the energy is applied in front of the cyclone suggests that it is perpetually renewed in front, and that in fact its motion and transmission are hence rather to be explained by some process analogous to the transmission of a wave." This may be regarded as a noteworthy corroboration of views seriously antagonistic to present theories, and seems to indicate a significant advance in theories of storm generation. (See also in this connection this journal, No. 423, p. 150, and *Scientific American Supplement*, Jan. 18, 1890.)

(The following journals have been consulted in making up the above paper: *Comptes Reudus*, Aug. 20, 1890; Sept. 15, 1890; Oct. 6, 1890; Dec. 22, 1890; *Das Wetter*, December, 1890; April, 1891; and *American Meteorological Journal*, April, 1891.)

H. A. HAZEN.

Washington, D.C., May 22.

BOOK-REVIEWS.

Our Common Birds, and How to Know Them. By JOHN B. GRANT. New York, Scribner. Oblong 12°. $1.50.

THIS is an attractive little volume which cannot fail to interest any one who loves nature and to be helpful to him who wishes to become intelligent upon our common birds.

To quote from the modest introduction: "The author desires to disclaim great scientific knowledge of birds and their ways, his object being not so much to impart information as to point his readers to the way of acquiring it for themselves." It becomes quite evident, however, that Mr. Grant can tell us much more than he does, when we have mastered the first steps.

Some seventy portraits of birds on separate plates are given; the significant characteristics of each are so closely brought out, that, in connection with the text, it makes identification of the real object a comparatively simple matter.

The writer succeeded, during one hour spent in a small thicket a few hundred feet from his house, in New Jersey, in matching bird and picture of about a dozen specimens.

The book is of convenient size for carrying about, and would be as valuable an addition to the library of every school boy and girl as it is interesting to any one who, in his love of nature, "holds communion with her visible forms."

Appletons' School Physics. By JOHN D. QUACKENBOS, literary editor; ALFRED M. MAYER; FRANCIS E. NIPHER; SILAS W. HOLMAN; FRANCIS B. CROCKER. New York, Cincinnati, Chicago, American Book Company, 1891. $1.20.

THE title of this book shows what place it is intended to fill, and the list of authors shows how earnestly the publishers have attempted to make a book that shall fill that place with satisfaction. The literary editor, Dr. Quackenbos, is a professor of English at Columbia College, and is a member of the New York Academy of Sciences and a fellow of the New York Academy of Medicine. To each of the four scientific men whose names follow that of Dr. Quackenbos on the title-page has been assigned a special department of physics. Professor Mayer of the Stevens Institute,

so well known for his works and investigations on sound, treats of that subject; Professor Nipher of Washington University, St. Louis, gives the chapters on heat, light, and the principles of electricity; Professor Holman of the Massachusetts Institute of Technology gives the introductory portions on matter and motion; and the applications of electricity and magnetism are handled by Mr. Crocker of the School of Electrical Engineering of Columbia College. It is needless to say that these are all men prominent in their several departments.

It would naturally be possible that an honest difference of opinion should exist as to the best way of presenting physical problems to young minds, but throughout this book we find evidences of an earnest purpose by competent men to do this according to their best judgment, and we believe the book is destined to do great good in our schools. The amount of apparatus required is not excessive, and the amounts of descriptive matter and experiment seem well balanced.

AMONG THE PUBLISHERS.

IN the *New England Magazine* for June there is an interesting illustrated article on the "Early Days of the First Telegraph Line," by Steven Vail.

— "Not to the Swift" is the title of an entertaining novel from the pen of Lewis H. Watson, just published by the Welch, Fracker Company of this city (400 p., cloth, $1.25). The scene is laid in this country, about the time of the Rebellion, some of the plots connected with that event being woven into the fabric of the story, and one of the plots, at least, being given an entirely new and somewhat startling significance in the process of weaving.

— There has recently been issued by the Missouri Botanical Garden, St. Louis, a report on "The Species of Epilobium occurring North of Mexico," by Professor William Trelease.

— To the June *Atlantic* Professor George Herbert Palmer contributes "Reminiscences of Professor Sophocles," who was professor of Greek at Harvard University for nearly forty years, — a simple and Homeric figure, caring nothing for outward forms and fashions, and with his thoughts oftener in Arabia than Cambridge, drawn from a monastery to give himself up to what he called "the ambition of learning." College men will be also deeply interested in Mr. S. E. Winbolt's paper on "Rowing at Oxford." In the same number President D. C. Gilman of Johns Hopkins University has a paper on "The Study of Geography," and its place in the college course.

— The first of a series of descriptive and illustrated quarto memoirs on the *Vertebrata* of the Tertiary and Cretaceous rocks of the Canadian North-west Territory, prepared by Professor E. D. Cope of Philadelphia, has just been issued by the Geological Survey of Canada. It is exclusively devoted to a consideration of the species from the Lower Miocene deposits of the Cypress Hills in the district of Alberta, and consists of twenty-seven pages of

Publications received at Editor's Office, May 20-26.

GEOLOGICAL Survey of New Jersey, Annual Report of the State Geologist for the Year 1890. Trenton, Murphy, pr. 305 p. 8°.
PROFITABLE Advertising. Vol. I. No. 1. *m.* Boston, C. F. David. 32 p. 8°. $1 per year.
VERNON-HARCOURT, L. F. Achievements in Engineering during the Last Half Century. New York, Scribner. 311 p. 8°. $1.75.
WALLACE, A. R. Natural Selection and Tropical Nature. London and New York, Macmillan. 492 p. 8°. $1 75.
WATER Commissioners of the City of Taunton, Mass., Fifteenth Annual Report of the. Taunton, Hack, pr. 67 p. 8°.
WEST Virginia Agricultural Experiment Station, Third Annual Report of the. Charleston, Donnally, pr. 185 p. 8°.

letter-press, illustrated by fourteen full-page lithographic plates. Part 2, which will contain illustrated descriptions of the vertebrates of the Laramie formation of the North-west Territory, by the same author, is now in course of preparation.

— The American Society for the Extension of University Teaching will shortly issue the first number of *University Extension*, a journal devoted to the interests of the movement for popular education known as university extension, which has taken such a strong root in this country at many centres. The periodical will serve as the organ of the society, and will constitute a general depository of information relating to the subject, and will be devoted to arousing and sustaining a public interest in all that pertains to this branch of popular education. All communications should be addressed to the society, 1602 Chestnut Street, Philadelphia.

— John Burroughs's "Talk about Wild Flowers," in *St. Nicholas* for June, will show botanists how to make their science "understanded of the people," and may also suggest to them a few particulars upon which fuller information is desirable.

— The eyes of travellers and pleasure-seekers who are weary of the beaten paths are just now turned towards Alaska, which is said to possess some of the most marvellous scenery in the world. An article describing a trip to Alaska and the beauties of its mountains and valleys is contributed to *Lippincott's Magazine* for June, by Grace Peckham, M.D.

— The "Third Biennial Report of the California State Board of Forestry" contains a monograph, with thirty illustrations, of the cone-bearing trees of the north-west, including California. Persons desiring corrected copies can obtain them by sending 10 cents per copy (to cover expense of wrapping, postage, etc.) to J. G. Lemmon, botanist of the board, 1015 Clay Street, Oakland, Cal. A few copies remain of the previous report describing the "Pines of the Pacific Slope," with twenty-four illustrations.